

Reconstruction of Mandible With Costochondral Graft : 11 Year Follow Up

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Abstract:

A boy in his early childhood was brought to OMFS department with a chief complaint of swelling in left side of the face 11 years ago. After thorough clinical, radiographic investigations he was suspected to present with ameloblastoma in left mandible. Considering the aggressive nature of the lesion, the plan was to excise the lesion in toto and reconstruct. Age being a fortune, a costochondral graft was harvested to reconstruct the mandible hoping that the intricate structure, Temporomandibular joint (TMJ) will be formed in the future. Patient was routinely followed up over the years. Recent follow up revealed an outcome of completely formed anatomy of mandible along with the Temporomandibular Joint with total functionality and aesthetics.

Keywords: RCU Reconstruction, Ameloblastoma, Costochondral grafting.

Introduction

Background: Mandible, the strongest and only movable bone in face also is found to be involved in various destructive pathologies, Ameloblastoma being the most common pathology. In spite of the several ways to reconstruct mandible in a range of age variations, In the growing age group, reconstruction remains a challenge as the graft/ implant is expected to have growth potential and reform the anatomy. The use of costochondral grafts is well-documented, but long-term outcomes remain sparsely reported. This case report discusses a 11-year follow-up of a paediatric patient who underwent segmental mandibular resection and reconstruction with a costochondral rib graft. The case highlights surgical outcomes, and functional rehabilitation, emphasizing the long-term viability of this approach.

Case Presentation: A boy in his early childhood was brought to the department of oral and maxillofacial surgery with a chief complaint of swelling in left side of his face since the past 3 months. He presented with facial asymmetry, a firm, nontender extraoral swelling over the left angle of the mandible [Fig 1A, Fig 1B, Fig 1C] which measured approximately of 3cm x 4cm in size. Intraorally patient presented with complete primary dentition with the same bony hard swelling distal to 75 (Fédération Dentaire Internationale nomenclature). No signs of infection were appreciated. No relevant past medical history reported.[1]



Figure 1. Pre-operative presentation. (A) Profile picture showing facial asymmetry; (B) intra-oral photograph showing vestibular obliteration; (C) worm's-eye view showing diffuse swelling on the left side.

Investigations:

1. Computed Tomogram - facial bones revealed unicystic mass with extensive bone lysis and cortical expansion [Fig 2A, Fig 2B, Fig 2C].

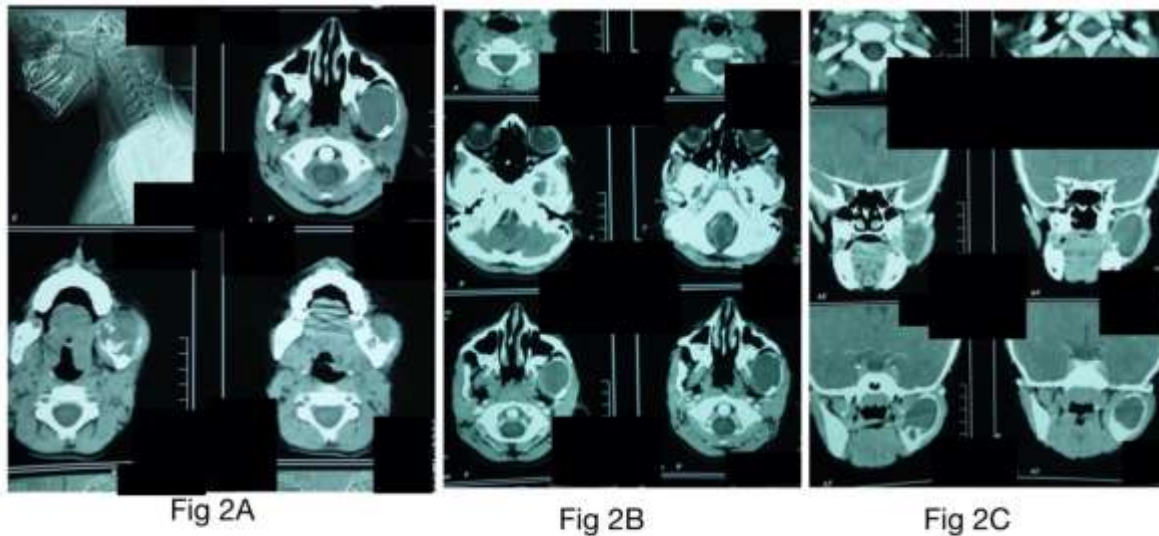


Figure 2. Computed tomogram of the facial bones. (A, B) Axial sections showing buccal and lingual cortical expansion; (C) coronal section showing involvement of the condylar process of the mandible.

2. Panoramic radiograph revealed destruction of bone in the left mandible [Fig 3]

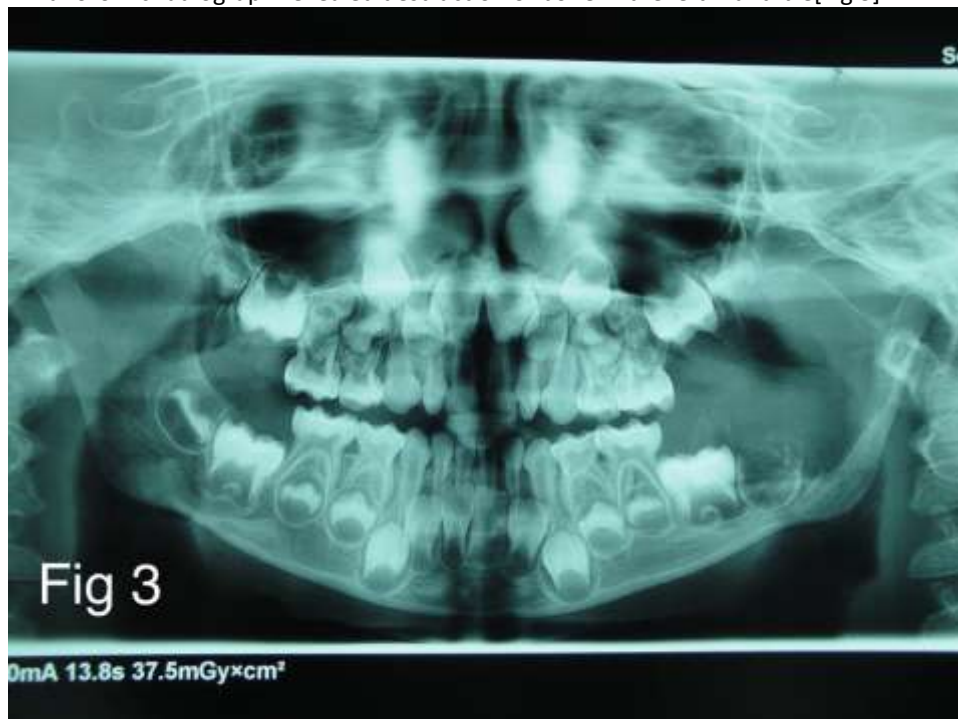


Figure 3. Pre-operative panoramic radiograph showing destruction of bone in the left mandible.

Differential Diagnosis:

Odontogenic Keratocyst (OKC)

•Clinical Presentation:

The OKC is often asymptomatic, but it can cause swelling or pain if large. It tends to present in younger patients, particularly in the second and third decades of life. When symptomatic, there might be tooth displacement or mobility. OKC has a predominant anteroposterior growth [2,3].

•Radiographic Features:

OKCs appear as well-defined, unilocular or multilocular radiolucencies with smooth or scalloped borders, often associated with the crown of an unerupted tooth (like the third molar or canine). The lesion is typically expansile and may cause cortical thinning, but the surrounding bone is less destructive than ameloblastoma [4,5].

Dentigerous Cyst

•Clinical Presentation:

A dentigerous cyst is usually linked to an unerupted tooth, especially third molars or canines. It can appear as a non-painful lump in the jaw, frequently observed on standard X-rays. In certain situations, it might lead to postponement in eruption or misalignment of the related tooth [6,7].

•Radiographic Features:

The dentigerous cyst encases the crown of an unerupted tooth and is typically unilocular, appearing as a clearly defined radiolucent area. It can lead to the enlargement of the cortical bone, but is generally less aggressive regarding bony destruction when compared to ameloblastoma [8].

Odontogenic Myxoma

•Clinical Presentation:

Odontogenic myxoma appears as a gradual, painless enlargement, frequently discovered incidentally during radiographic assessments. It typically impacts the mandible in younger individuals (frequently during their second or third decades of life) [9].

•Radiographic Features:

Odontogenic myxomas exhibit a multilocular or honeycomb shape, resembling ameloblastoma. They may lead to the growth of cortical bone, but the edges are usually less distinct than those of ameloblastomas. Myxomas exhibit greater radiolucency compared to ameloblastomas and typically do not demonstrate the same level of cortical destruction [10,11].

Juvenile Ossifying Fibroma (JOF)

•Clinical Presentation:

Juvenile ossifying fibroma generally impacts younger individuals, frequently occurring within the first twenty years of life, and manifests as a painless, gradually enlarging lump in the jaw. It may be linked to facial asymmetry because of its expansile characteristics [12].

•Radiographic Features:

JOF presents as a clearly defined radiolucent area that can demonstrate areas of mixed radiolucency and radiopacity, indicating ossification inside the lesion. The lesion can lead to cortical enlargement and at times, tooth displacement. The boundaries of JOF are usually more distinct when compared to the vague borders of ameloblastoma [13,14].

Summary:

Condition	Growth Pattern	Radiographic Features	Tooth Resorption	Cortical Expansion	References
Ameloblastoma	Slow-growing, aggressive	Multilocular, "soap bubble"	Yes	Yes	[2],[3]
Odontogenic Keratocyst (OKC)	Slow-growing	Unilocular/multilocular, minimal expansion	No	Minimal	[4], [5],[6]
Dentigerous Cyst	Painless, associated with unerupted tooth	Unilocular, well-defined	No	Mild	[7],[8],[9]
Odontogenic Myxoma	Slow-growing	"Honeycomb" multilocular	No	Yes, but less than ameloblastoma	[10],[11],[12]

Juvenile Ossifying Fibroma (JOF)	Rapidly growing	Mixed radiolucent-radiopaque	No	Yes, significant	[13],[14],[15]
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Treatment:

Under general anesthesia and nasotracheal intubation, a submandibular incision was performed to reveal the pathology [Fig 4A], while taking care to preserve important structures like the facial artery, marginal mandibular nerve, and mental nerve whenever feasible. Segmental mandibular resection was conducted [Fig 4B] distal to 75 including the condylar and coronoid process of mandible preserving the periosteum at the resection site and articular disc, guaranteeing a clear surgical margin[Fig 4C].

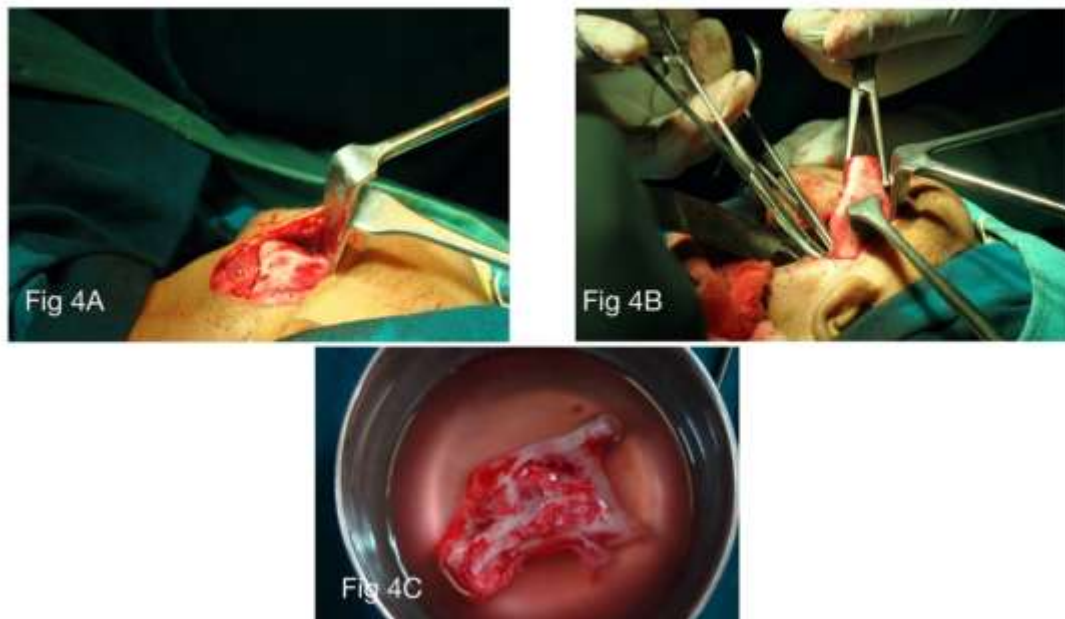


Figure 4. Intra-operative images. (A) Exposure of the pathology; (B) segmental resection of the mandible; (C) resected mandibular specimen.

The right 5th rib was used to obtain the costochondral rib graft, while preserving the costochondral junction for TMJ reconstruction [Fig 5A, Fig 5B, Fig 5 C].



Figure 5. Costochondral rib graft harvest. (A) Marking for harvesting the rib graft; (B) harvesting of the rib; (C) harvested costochondral rib graft.

The bony section was moulded to accommodate the mandibular defect, whereas the cartilaginous section was placed inside the glenoid fossa for reconstruction of the condyle. The graft is then fixed in position with a 2mm x 4Hole titanium plate and screws[Fig 6] , providing stable support without undue strain.



Figure 6. Harvested rib graft secured in place with titanium plate and screws.

Once the mouth opening, occlusion, alignment of the graft and stability have been confirmed, a layered closure of the soft tissues is executed. Postoperative care involves progressive physiotherapy to promote jaw movement. Ongoing follow-up is crucial to assess graft integration, occlusal stability, facial symmetry, and TMJ function, guaranteeing the best functional and aesthetic results.

Outcome and Follow up:

The post operative period was uneventful. Patient was followed up annually in which no fresh complaints were put forward.

5 year follow up :

Patient presented with restored facial symmetry, adequate mouth opening of 35 mm, normal lateral movements of TMJ [Fig 7].



Fig 7

Figure 7. 5-year follow-up: profile and lateral views, and lateral movements of the TMJ.

CT facial bones revealed reformed anatomy of TMJ with a bony overgrowth beneath the region of sigmoid notch [Fig 8]. It was considered clinically insignificant as the patient had no functional or aesthetic complaints. Considering the future growth, plate and screws removal was performed in the same year. Patient was followed up annually during when the overgrowth was not found to vary.

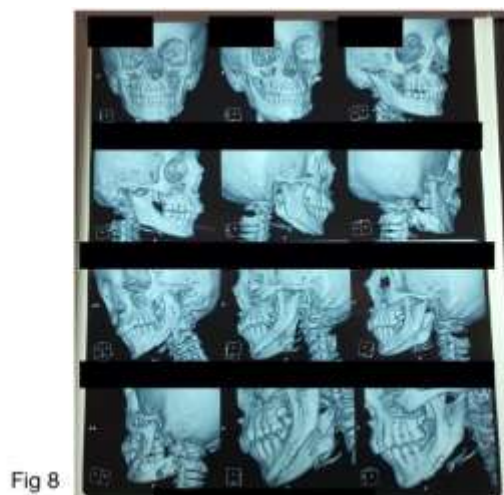


Figure 8. CT facial bones (3D reconstruction) at 5-year follow-up showing reformed TMJ anatomy and bony overgrowth beneath the sigmoid notch.

11 year follow up revealed restored symmetry [Fig 9A, Fig 9B, Fig 9c, Fig 9D] , mouth opening of 37mm [Fig 10C, Fig 10D] , normal movements of TMJ [Fig 10A, Fig 10B] , minimal scar and no clinical complaints regarding the bony overgrowth.



Figure 9. 11-year follow-up. (A) Profile view; (B) worm's-eye view showing minimal scarring; (C, D) lateral views.



Figure 10. 11-year follow-up. (A, B) Lateral movements of the TMJ; (C) mouth opening; (D) measurement of mouth opening, 37 mm; (E) intra-oral view showing missing 36.

Panoramic radiograph revealed sustained anatomy of condylar process, sigmoid notch and coronoid process of mandible [Fig 11].



Figure 11. Panoramic radiograph at 11-year follow-up showing sustained anatomy of the condylar process, sigmoid notch and coronoid process.

Patient is healthy, socially carrying out everyday activities. Chest Xray revealed normal thoracic anatomy [Fig 12A, Fig 12B] .

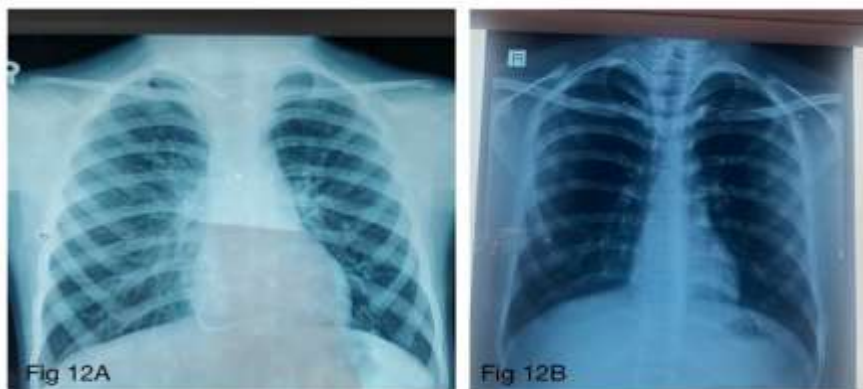


Figure 12. Chest radiographs. (A) Pre-operative; (B) 11 years post-operative, showing normal thoracic anatomy at the donor site.

Intra oral examination revealed normal mucosa with missing 36 [Fig 10E] . A Cone beam computed radiography revealed a buccolingual width of 4.16mm in relation to 36 [Fig 13]. Prosthetic rehabilitation will be planned in the following year. Density of bone is observed to be in par with the right mandible [Fig 13].



Figure 13. Post-operative CBCT (axial) showing a buccolingual width of 4.16 mm in relation to 36 and bone density of the grafted site comparable to the right mandible.

Discussion:

Ameloblastoma is an uncommon yet locally invasive odontogenic tumor that primarily impacts the mandible. Pediatric cases make up around 10% to 15% of all ameloblastomas, presenting distinct challenges because of continuous craniofacial development and the need for prolonged functional and aesthetic restoration (15).

Surgical Approaches and Difficulties

Total surgical removal is still the gold standard approach for ameloblastoma to reduce the risk of recurrence. Nevertheless, in pediatric patients, surgical procedures need to be meticulously organized to maintain mandibular function and support upcoming skeletal development (16). The selection of a reconstruction method is essential for achieving positive results. Costochondral rib graft (CCRG) reconstruction has gained favor because of its natural growth capacity, simplicity of extraction, and capability to replicate the original temporomandibular joint (TMJ) (17). In contrast to non-vascularized bone grafts, CCRG includes a cartilaginous section that can merge with the TMJ, enabling ongoing growth as time progresses (18).

Enduring Functional and Visual Results

Ongoing long-term assessment of pediatric mandibular reconstructions is crucial for observing skeletal adaptation, occlusal stability, and TMJ performance. Various research works have documented positive results with CCRG, such as normal mandibular motions, occlusion, and facial symmetry (19). Nonetheless, possible complications like overgrowth, resorption of the graft, or asymmetry have been noted, occasionally necessitating further corrective procedures (20). In our case, the patient preserved excellent mandibular function, occlusion, and facial appearance throughout the 11-year follow-up interval without the need for further surgical interventions.

Alternative Reconstructive Solutions

Additional reconstructive methods involve free vascularized fibula grafts (FVFG) and personalized CAD/CAM titanium implants. FVFG is a recognized method for reconstructing the mandible, offering a dependable vascularized bone source with slight resorption. Nevertheless, its use in young children is restricted because of the small size of donor vessels and the intricacy of microsurgical methods (21). Recently, custom or stock total joint replacement prosthesis utilizing CAD/CAM technology have been developed for mandibular reconstruction, providing accurate anatomical restoration. Nonetheless, worries persist about prosthesis contamination, durability over time, and possible TMJ dysfunction (22). In comparison to these options, CCRG continues to be beneficial because it can adjust to mandibular growth and has low donor site morbidity (23).

Conclusion

This case illustrates the success of CCRG reconstruction after segmental resection of ameloblastoma in a child. The 11-year follow-up shows outstanding functional, aesthetic, and skeletal results with no major complications. Although ongoing observation is crucial, CCRG continues to be an important reconstructive choice for pediatric mandibular defects, maintaining a balance between growth potential and structural strength. Future studies ought to concentrate on determining predictive elements for enduring stability and the necessity for additional interventions in developing patients. No alteration observed in the bony overgrowth [Fig 14]



Figure 14. Post-operative CBCT (3D reconstruction) showing no alteration in the bony overgrowth.

LEARNING POINTS/TAKE HOME MESSAGES:

- The surgical importance of retaining the periosteum which results in reformation of anatomy based on functional matrix theory is emphasized
- Early diagnosis and treatment increase the chances for the patient to be tumour free and increases quality of life.
- Selection of graft for reconstruction is influenced by several factors including age and is crucial for a good surgical outcome
- Long term follow up is necessary for such cases to monitor in view of recurrence and condition of the surgical site.

PATIENT'S PERSPECTIVE

Following jaw surgery, things were challenging at first but got easier with time. It was difficult to talk and eat regularly for the first few days because of the pain and swelling. As a kid, dealing with the questions from my friends around my swelling and surgery was confusing and exhausting as I did not know better. Although now its rewarding to know that my parents made the right decision by consenting for surgery then, so that I have a normal shape of face. It took some time to get used to the alterations in the jaw and face, and concerns about how things would mend persisted. Though there were occasional frustrating moments, particularly during development spurts when the face and jaw didn't always seem properly balanced, daily tasks like chewing and talking got simpler as the months went by. Frequent trips to the doctor became common place, bringing with them both comfort and concern about potential future therapies. The capacity to eat comfortably, smile, and go about daily life without discomfort or significant difficulty gradually returned to normal despite the challenges. Ability to return to normalcy made the journey feel worthwhile. While concerns about appearance and function remained, they became less overwhelming, and in the end, the experience was one of adaptation and resilience. The fact that I used to be shy to pose for pictures and after surgery I followed my passion and became a photographer is ironical.

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